
NASA-02811 (March 2003)
NATIONAL AERONAUTICS NASA
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SECTION 02811

UNDERGROUND SPRINKLER SYSTEMS
03/03

NOTE: Delete, revise, or add to the text in this
section to cover project requirements. Notes are
for designer information and will not appear in the
final project specification.

This section covers work in connection with the
installation of an outdoor underground sprinkler
system complete. Automatic sprinkler systems for
fire protection are covered in Section 13930, "Fire
Sprinkler Systems." Deluge automatic sprinkler
systems for fire protection are covered in Section
13950, "Deluge Sprinkler Systems."

PART 1 GENERAL

1.1 REFERENCES

NOTE: The following references should not be
manually edited except to add new references.
References not used in the text will automatically
be deleted from this section of the project
specification.

The publications listed below form a part of this section to the extent
referenced:

ASME INTERNATIONAL (ASME)

ASME B16.23 (1992) Cast Copper Alloy Solder Joint
Drainage Fittings-DWV

ASTM INTERNATIONAL (ASTM)

ASTM B 43 (1996) Standard Specification for Seamless
Red Brass Pipe, Standard Sizes

ASTM D 1784 (1999) Standard Specification for Rigid

Poly (Vinyl Chloride) (PVC) Compounds and
Chlorinated Poly (Vinyl Chloride) (CPVC)
Compounds

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 5752 (1982) Metal Valves for Use in Flanged
Pipe Systems - Face to Face and Center to
Center Dimensions

ISO 7005 (1992) Metallic Flanges

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80 (1997) Bronze Gate, Globe, Angle and Check
Valves

MSS SP-86 (1987; R 1992) Guidelines for Metric Data
in Standards for Valves, Flanges, Fittings
and Actuators

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electric Equipment
(1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

1.2 SUBMITTALS

**NOTE: Review submittal description (SD) definitions
in Section 01330, "Submittal Procedures," and edit
the following list to reflect only the submittals
required for the project. Submittals should be kept
to the minimum required for adequate quality
control. Include a columnar list of appropriate
products and tests beneath each submittal
description.**

The following shall be submitted in accordance with Section 01330,
"Submittal Procedures," in sufficient detail to show full compliance with
the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted prior to
the start of work.

SD-02 Shop Drawings

As-Built Drawings shall be submitted in accordance with the paragraph entitled, "Drawings," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

- Piping
- Gate Valves
- Quick-Coupling Valves
- Check Valves
- Automatic Controllers, Electrical
- Remote Control Valves, Electrical
- Electrical Power, Supply Voltage
- Control Voltage
- Sprinkler Heads
- Tree Irrigators

Spare Parts Data for the complete sprinkler system shall be submitted. Data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as part of the contract; and a list of additional items recommended by the manufacturer to ensure efficient operation for a period of 120 days at the particular installation.

SD-04 Samples

Samples of the following items shall be submitted:

- Piping
- Gate Valves
- Quick-Coupling Valves
- Check Valves
- Automatic Controllers, Electrical
- Remote Control Valves, Electrical
- Sprinkler Heads
- Tree Irrigators

SD-06 Test Reports

Test reports for Hydrostatic Test shall be submitted.

SD-07 Certificates

Certificates of compliance shall be submitted for the following items in accordance with the applicable reference standards and description of this section:

- Piping
- Gate Valves

Quick-Coupling Valves
Check Valves
Automatic Controllers, Electrical
Remote Control Valves, Electrical
Electrical Power, Supply Voltage
Control Voltage
Sprinkler Heads
Tree Irrigators

SD-08 Manufacturer's Instructions

Manufacturer's instructions for Equipment and System Packages shall be submitted in accordance with the paragraph entitled, "Equipment Systems Packages," of this section.

The following Special Tools shall be submitted upon completion of the project:

Wrenches
Keys
Coupler(s)/Matching Hose Swivels
Soil Probe.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with the paragraph entitled, "Equipment Systems Packages," of this section.

1.3 SPECIAL REQUIREMENTS

The Contractor shall coordinate the installation of sprinkler materials with the landscape drawings to avoid interfering with planting.

The Contractor shall verify location and dimensions for sprinkler system lines before commencing excavation.

The Contractor shall replace existing paving disturbed during the course of this work at no additional cost to the Government. New paving shall be equal in every way to the material removed.

The Contractor shall obtain and pay for permits and inspections required.

1.4 CONTROLLER CHARTS

The Contractor shall provide one controller chart for each controller supplied, showing the area covered by the automatic controller.

When completed and approved, the charts shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils 0.508 millimeter thick.

1.5 MATERIAL, EQUIPMENT AND FIXTURE LISTS

Material, Equipment, and Fixture Lists for major components of the sprinkler system shall be submitted prior to start of work.

1.6 DRAWINGS

As-Built Drawings shall be submitted with current factual information including deviations from, and amendments to the drawings and changes in the work, concealed and visible.

1.7 EQUIPMENT SYSTEMS PACKAGES

Manufacturer's instructions shall be submitted for Equipment and System Packages requiring special provisions. Special notices shall detail impedances, hazards and safety precautions.

Operation and Maintenance Manuals shall be submitted bound in manual format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

1.8 SPECIAL TOOLS

1.8.1 Wrenches

Two wrenches for disassembling and adjusting each type of sprinkler head provided by the Contractor upon completion of the project.

1.8.2 Keys

Two keys for each automatic controller shall be provided by the Contractor upon completion of the project.

1.8.3 Coupler(s)/Matching Hose Swivels

Four coupler(s) and matching hose swivels, equipped with globe valves shall be provided by the Contractor upon completion of the project.

1.8.4 Soil Probe

One soil probe 36-inches 900 millimeter in length.

1.9 SPARE PARTS DATA

Spare Parts Data for the complete sprinkler system shall be submitted. Data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as part of the contract; and a list of additional items recommended by the manufacturer to ensure efficient operation for a period of 120 days at the particular installation.

PART 2 PRODUCTS

2.1 PIPING, GENERAL

Supply lines shall be PVC, Schedule 40.

2.2 PLASTIC PIPE AND FITTINGS

Solvent weld pipe shall be extruded of an improved polyvinylchloride (PVC) virgin pipe compound. The compound shall conform to ASTM D 1784, Cell Classification 12454-B, and have a 2,000-pound per square inch (psi) 13.8 Megapascal hydrostatic design stress rating.

Pipe shall bear the following markings: manufacturer's name, nominal pipe size, schedule or class, pressure rating in psi, and NSF International (NSF) seal. The manufacturer shall also mark the date of extrusion on the pipe.

Solvent cement or rubber-gasket joints for pipe and fittings shall be made as prescribed by the manufacturer.

Fittings shall be standard weight, Schedule 40.

Fittings shall be injection molded of an improved PVC compound. Fittings shall conform to ASTM D 1784, Cell Classification 12454-B.

Tees and ells shall be side-gated.

Fittings shall bear the company's name and trademark, material designation, size, applicable iron pipe size (ips) schedule, and NSF seal of approval.

Threaded nipples shall be standard-weight, Schedule 80, with molded threads.

2.3 BRASS PIPE AND FITTINGS

Brass pipe shall be 85-5-5-5-percent red brass, Schedule 40, screwed pipe conforming to ASTM B 43.

Fittings shall be medium brass, screwed, 125-pound 862 kilopascal (125-pound) class conforming to ASME B16.23.

2.4 GATE VALVES

NOTE: Insert valve type, class, and style.

Gate valves under 3 inches DN75 shall be in accordance with MSS SP-80, MSS SP-86, ISO 5752, and ISO 7005, [____], Class [____], and Style [____].

Valves shall be housed as detailed. Valves in traffic areas shall be enclosed in concrete with cast-iron lids.

2.5 QUICK-COUPLING VALVES

Bodies of valves shall be red brass with a wall thickness to withstand a working pressure of 150 psi 1034 kilopascal without leakage.

Valves shall have 3/4-inch 19 millimeter (3/4 inch) female threads opening at base.

Valves shall be constructed to operate with special connecting couplers designed for that purpose. A positive, watertight connection shall be made between coupler and valve.

The hinge covers shall be red brass with a rubber-like vinyl cover bonded to them in such a manner that they become permanent covers, yellow in color.

Valves shall be located within 12 inches 300 millimeter of the hardscape, unless otherwise indicated.

2.6 CHECK VALVES

Swing check valves 3 inches DN75 and smaller shall be bronze construction, 100-pound 445 newton (100-pound) rating, female.

Antidrain valves shall be plastic construction with soft composition disks and internal parts of corrosion-resistant steel. The spring tension shall be adjustable from 4 to 15 psi 28 to 104 kilopascal.

2.7 AUTOMATIC CONTROLLERS, ELECTRICAL

Controllers and wiring shall conform to the requirements of Section 16145, "Standard Wiring Systems," and Section 16286, "Overcurrent Protective Devices."

Controllers shall be fully automatic and capable of operating the number of stations indicated.

Controllers shall be pedestal-mounted NEMA Type [3R] [4] enclosure with a heavy-duty, weather-proof, watertight case and [locking] hinged cover [with a hasp for a padlock].

Controllers shall be programmed for various schedules by setting switches and dials, and shall be equipped with the following features:

A switch for each day of the week, for three schedules, allowing each station to be scheduled individually as to days of watering.

A minute switch for each station with a positive increment range of 2 to 60 minutes. Time sets shall be accurate within 1 percent.

A repeat switch allowing selected schedules to be repeated after completion of the initial watering schedule and allowing repeat operations to be scheduled throughout a 24-hour day.

Components shall be UL listed and shall have acceptable overcurrent protection by means of circuit breakers or fuses. Controller chassis shall be grounded.

Controllers shall be equipped with approved disconnect switches rated for

120-volt service. Electrical receptacles shall be located inside housings.

Exact location of controllers shall be determined in the field before installation. The Contractor shall be responsible for coordinating the electrical service to these locations.

2.8 REMOTE CONTROL VALVES, ELECTRICAL

Valves shall be spring-loaded, packless diaphragm-activated, with plastic bodies and corrosion-resistant steel trim and seats, normally closed, equipped with flow controls.

Valves shall be slow closing (10 seconds minimum) with no adjustments or settings required.

Valves shall be capable of operating on a minimum flow of 1 gallon per minute 3.8 liter per minute (1 gpm).

Valves shall be capable of being operated in the field, without electricity at controllers, by bleeder valves.

Valves shall be installed in shrub areas whenever possible and installed according to details.

2.9 ELECTRICAL POWER, SUPPLY VOLTAGE

Wiring shall conform to the requirements of Section 16145, "Standard Wiring Systems."

Power and connection to the automatic controller will be provided by [contractor.] [others.]

2.10 WIRING, CONTROL VOLTAGE

Wiring shall conform to the requirements of Section 16145, "Standard Wiring Systems."

Connections between the controllers and remote control valves shall be made with direct-burial Type UF wire, sized and installed in accordance with NFPA 70 and the valve manufacturer's wire chart and specifications.

Wiring shall occupy the same trenches and be installed along the same route as the supply lines, wherever possible.

Where more than one wire is placed in a trench, the wiring shall be taped together at intervals of [_____] feet millimeter.

Splices shall be made using Scotch-Lok Unipack waterproof scaling packets, Pen-Tite Connectors, or equal. An expansion loop of 12 inches 305 millimeter shall be provided at each wire connection and directional turn.

Wire sizing shall be according to the manufacturer's recommendations, and in no case less than No. 14 AWG 1.6 millimeter (No. 14 AWG) in size.

A continuous wire shall be used between the controller and remote-control valves. Under no circumstances shall splices exist without prior approval. Any splices allowed shall be installed in an approved box conforming to NEMA 250.

Ground wires shall be green.

2.11 SMALL SHRUBBERY SPRINKLER HEADS, ADJUSTABLE

Fixed sprinkler heads shall have removable spray tips of full-, half-, third-, and quarter-circle patterns, as required, with bodies and nozzles of brass. Bodies shall be equipped with 1/2-inch 15 millimeter (1/2 inch) female threads and, where indicated, shall be pop-up types with heights of 6 inches 150 millimeter.

2.12 SMALL LAWN SPRINKLER HEADS

Fixed-head pop-up sprinklers shall have removable spray tip nozzles of full-, half-, third-, or quarter-circle pattern, as required. The pop-up feature should consist of a piston to which a spray-tip nozzle is attached. It shall have a synthetic rubber gasket and be of sufficient height to permit it to rise at least 1 inch 25 millimeter while in operation.

Bodies shall be cast red brass, and recesses for pistons shall be sufficiently deep to contain them completely within bodies of sprinkler heads.

Pistons or piston parts, spray-tip nozzle, and other parts shall be red brass. Pistons shall be circular in cross section and fit sufficiently close in a machined hole at the top of the head (or have a machined flange and seat) to exclude debris from entering the recess.

Lawn heads shall be adjustable by means of setscrews.

Spray-tip nozzles shall be 5/8 - 16 16M - 2 (5/8 - 16) thread size.

Lawn heads shall be equipped with lawn protector. Protectors shall be 5-1/2 inches 140 millimeter in diameter, manufactured of plastic material, with a hole in the center large enough to allow lawn sprinkler heads, when installed, to be flush with the surrounding area of protectors. Protectors shall be dark green, have a minimum thickness of 1/8 inch 3.2 millimeter, with adequate ribbing to support outer flange. Half-circle sprinklers shall be furnished with protectors having one straight side.

2.13 TREE IRRIGATORS

[Each tree shall be provided with a water spigot outlet for watering as indicated, including vents.]

[Each tree shall be provided with a drip irrigation system as indicated.]

PART 3 EXECUTION

3.1 INSPECTION SCHEDULE

The Contractor shall notify the Contracting Officer, in advance as indicated, for the following inspections:

Prejob conference - 7 days

Supply-line installation and testing - 36 hours

System layout - 36 hours

Coverage tests - 36 hours

Final inspection - 48 hours

As-built drawings shall be available for all inspections.

During performance of the final inspection, the Contractor shall be responsible for having radio communication capabilities or sufficient personnel so that directions from the inspection area to the controller of the system can be readily accomplished.

3.2 WATER SUPPLY

Connections to the outlet shall be at approximate locations shown. Minor changes caused by actual site conditions shall be made without additional cost to the Government.

3.3 LAYOUT

Sprinkler heads shall be laid out, making minor adjustments required due to differences between sites and drawings, without additional cost to the Government.

3.4 GRADES

Before the start of work, grades shall be verified to determine that the work may safely proceed, keeping within specified material depths.

3.5 ASSEMBLIES

Backflow assemblies shall be installed in shrub areas and at heights required.

Supply lines as indicated are diagrammatic. Lines (and various assemblies) shall be installed to conform to details.

Multiple assemblies shall not be installed on plastic lines. Each assembly shall be provided with its own outlet. When indicated, the pressure-relief valve shall be the last assembly.

Assemblies specified shall be installed according to the respective drawings and specifications.

Brass pipe and fittings and plastic pipe and threaded fittings shall be

assembled using Teflon tape applied to male threads only.

3.6 LINE CLEARANCE

Lines shall have a minimum clearance of 4 inches 100 millimeter from each other and 6 inches 150 millimeter from lines of other trades, unless specified or indicated otherwise.

Parallel lines shall not be installed directly above one another.

3.7 TRENCHING

The pipe shall be supported continuously on the bottom of the ditches and laid to an even grade. Where lines occur under paved area, dimensions shall be considered below subgrade.

A minimum cover of 18 inches 450 millimeter shall be provided over pressure-supply lines 2-1/2 inches 65 millimeter and smaller.

A minimum cover of 18 inches 450 millimeter shall be provided over control wire.

A minimum cover of 12 inches 300 millimeter shall be provided over nonpressure lines.

3.8 BACKFILLING

Initial backfill shall be of a fine granular material with no stones larger than 1/2 inch 13 millimeter in any dimension.

Backfill for trenching shall be compacted to a density equal to the adjacent undisturbed soil and shall conform to adjacent grades without irregularities.

Under no circumstances shall truck wheels be used for compacting soil.

3.9 FLUSHING THE SYSTEM

After lines and risers are in place and connected, and prior to installation of sprinkler heads, control valves shall be opened and a full head of water used to flush out the system.

3.10 SPRINKLER HEADS

Sprinkler heads shall be installed as indicated.

Spacing of heads shall not exceed the maximum indicated. In no case shall the spacing exceed the maximum recommended by the manufacturer.

3.11 COVERAGE TEST

When the sprinkler system is completed, a coverage test shall be performed to determine if the water coverage for lawn, planting, and turf areas is complete and adequate. Materials and work required to correct valve

alignment and inadequacies of coverage shall be provided by the Contractor at no additional cost to the Government. This test shall be accomplished before ground cover and planting operations commence.

3.12 TESTS

Pipe ditches shall not be backfilled until the pipe has been inspected, tested, and approved in writing.

The Contractor shall furnish the necessary test equipment.

A Hydrostatic Test shall be performed by the Contractor. Pressure-supply lines shall be tested under a hydrostatic pressure of 150 psi 1034 kilopascal for a period of 2 hours. Any visible leakage shall be repaired, and the system tested again.

Testing shall be approved prior to the installation of remote-control valves, quick couplers, or other valve assemblies.

3.13 FINAL CLEANUP

Upon completion of the work, the Contractor shall remove equipment, materials, and debris resulting from the installation.

-- End of Section --